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DESTRUCTIVE FOLIAGE DISEASES OF THE POTATO

This potato hill shows one stalk attacked by black leg and the other still healthy. The base of the stem turns black and rots and the leaves turn yellow and dry up.

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DESTRUCTIVE FOLIAGE DISEASES OF THE POTATO

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It is not uncommon to find potato fields in Iowa where 25 per cent of the vines are killed by one disease or another before the crop matures. That means a direct cut of the yield of tubers, because the leaves of the potato plant constitute the machinery by which it manufactures starch to store in the potatoes underground.

The tubers are also attacked by other diseases which are as numerous and injurious as those on the vines. It is obvious, therefore, that potato diseases are an important limiting factor in potato production in Iowa. Some of the most important diseases that show themselves on the vines will be described briefly in this circular along with control measures.

Fig. 1. Black leg. The signs of the disease begin at the seed piece and run up the stem, which turns inky black and gets soft. Finally the plant falls over and dries up.

BLACK LEG OF POTATOES

Black leg is a germ disease of the potato which causes a blackening and rotting of the stem. It usually begins near the seed piece and progresses upward as shown in fig. 1. In the meantime the leaves lose their rich green color, roll up, become yellowish green, and ultimately turn brown and dry up. (See illustration).

This disease may make its attack at any time after the plant appears above the ground until the vines are killed by frost,

providing the weather conditions are favorable. It is most common in Iowa in June and the first half of July, due to the fact that during this part of the season the weather is wet and warm. During the season of 1916, it was not uncommon to find fields and garden patches where from 4 to 12 per cent of the crop was destroyed. This was especially true of the Early Ohio, and Irish Cobbler varieties.

Black leg not only attacks the stems but also the tubers. It enters the stem end and causes a blackening of the flesh about the stem end. If the soil is warm and damp the tubers rot very quickly, but if the soil is dry, only the blackish discoloration indicates that the disease is present. Tubers with this type of infection carry the disease over from one year to another. It is probably harbored only in or on the seed. Northern grown seed is especially likely to be contaminated with this disease due to the climate being especially favorable for it.

Control: Black leg can be efficiently controlled by field and bin selection, coupled with the seed treatment described in another paragraph. Set aside a certain number of rows as a seed plot for seed for next year. When cultivating, watch for plants showing signs of black leg. These should be pulled and allowed to dry in the hot sun, which kills the germs, prevents others from becoming contaminated, and allows the healthy plants in the next hill to occupy the space taken up by the sick plant.

If northern grown seed is used each spring, buy the best, practice bin selection and seed treatment, and discard tubers with black streaks or rotten spots when cutting the seed.

CURLY DWARF

Curly dwarf is a disease of unknown cause that claims from 2 to 12 per cent of the potato crop in Iowa. It is readily recognized in that infected plants are small and bushy, later dropping their lower leaves, which are crinkled and curled, while the leaf stalks are brittle and snap off when touched. The relative size and character of foliage of sick and healthy plants is well shown in fig. 2. In late stages of this disease the leaves are spotted with numerous brown areas; more often, however, the leaves break away from the stem and dry up, leaving the stem naked except for the small cluster of leaves at the tip. The stem shows at this time numerous black streaks.

Such plants, at best, may produce only a very few tubers. In many cases these are small, ill shaped and borne on short stolons near the stem. Realizing that the unhealthy plants produce chiefly small tubers, it is plainly unwise to plant the small tubers rather than the larger ones.

Control: All plants showing the signs described above should be pulled out when cultivating as described in the case of black

Fig. 2. Curly dwarf. The two stunted, dwarfed plants at the right are infected with this disease. The one on the left is a healthy plant in the same row.

leg. This applies especially to the rows set aside for seed. See that only healthy plants are allowed to mature in the seed plot. Potatoes from curly dwarf hills produce curly dwarf the next year. Seed treatment does not control this disease nor does spraying do any good. Practice selection as with corn. The Early Ohio is especially susceptible to this disease, while the late variety Rural New Yorker is quite resistant.

TIP BURN

Tip burn occurs on nearly every potato plant growing during July and August. As the name suggests, it is a burning of the tips of the leaves which extends nearly around the margin of the leaflets, under Iowa conditions forming an irregular brown border of dead leaf tissue as shown in fig. 3. Very often this rolls up. This trouble is not due to a germ disease of any kind. It is induced by the leaves losing water faster during hot, dry days than the roots can supply it from the soil. Under this condition the margins of the leaves collapse and die. It is the green matter in the leaves that manufactures the food stored in the potato, so anything that cuts down the leaf area cuts the crop.

Control: Early varieties suffer more from this disease than the late sorts, due to their approaching maturity with the coming of hot weather of July and August. However, the late varieties are far from immune. Since this trouble is largely caused by a lack of water, good surface cultivation preventing evaporation from the soil helps to check this disease. Potatoes should be cultivated every ten days with the advent of the hot weather of July and August.

It has been shown also that bordeaux mixture checks this disease materially. The best results are secured by making two applications on early varieties and five on late varieties with the hot weather of July. Not only does this mixture check tip burn, but it has a stimulating effect on the potato plant. In experiments at the Iowa Agricultural Experiment Station covering a period of five years the average yield was increased 22 bushels per acre, the variations depending upon the thoroness of the spraying and on seasonal conditions.

Late varieties, like Rural New Yorker and Green Mountain, show less tip burn injury than the early varieties, such as Bliss Triumph, Early Ohio, and Irish Cobbler.

Fig. 3. Tip burn. The tips and margins of the leaves are killed by hot, dry weather in July and August and turn brown.

EARLY BLIGHT

Early blight is a spotting on the foliage caused by a fungus. These spots vary from ⅛ to ½ inch in diameter. Often one can see concentric ridges in the brown dead tissues. This is well illustrated in fig. 4. It attacks chiefly the late varieties during the first half of August, because the early varieties have, as a rule, matured by this time. From this time on it becomes more abundant and in some cases destroys considerable of the leaf surface which in turn cuts the yield of potatoes.

Control: This

Fig. 4. Early blight. The brown spots on the leaves are caused by a fungus which kills the leaf tissue. The disease does not appear until about the first of August and is of no importance except to late varieties.

disease fortunately yields to the same treatment as tip burn and is very effectively controlled, namely, by spraying with bordeaux mixture.

LATE BLIGHT

Late blight is a serious menace to potato production in the cooler and more northern potato growing sections of America and Europe, but fortunately it is not of common occurrence in Iowa. It is of importance in Iowa only when there is an exceptionally cool, wet season such as 1915, when it destroyed 50 per cent of the potato crop.

This disease attacks both the vines and tubers (see fig. 5). It begins as small, yellowish green irregular spots on the leaves during moist, cool weather. These spots increase very rapidly in size and often run thru a whole leaf in 48 hours. The infected tissue dies and turns brown. On the lower surface of infected spots is borne a white, glistening, mildew-like growth which bears the spores of the fungus producing the disease. These germinate or start to grow in the morning dew and lead to the production of thousands of other spots which also enlarge and kill the leaves and stems. It is not unusual when this disease is rampant to see a field of potatoes standing in apparently perfect growing condition one day and the following day find it cut to

the ground with nothing remaining but a brown mass of dead, decaying vines.

Late blight lives over, not in the soil, but in the seed. Northern grown seed is doubtless the source of infection of the Iowa crop. On the tubers it is evident in the spring by sunken areas on the surface of the tubers. The flesh shows a brownish discoloration which may be only nominal or include a large portion of the tuber. If tubers of this description are used for seed and weather conditions are favorable the disease travels up the stem as shown in fig. 6, to the surface of the soil and spreads to

Fig. 5. Late blight on leaves. This fungus trouble begins most often at the leaf margins and destroys the tissues very rapidly during wet weather in August and September.

Fig. 6. Late blight on stem. The fungus grows up stem from infected seed. Such plants start the disease in potato fields in favorable weather.

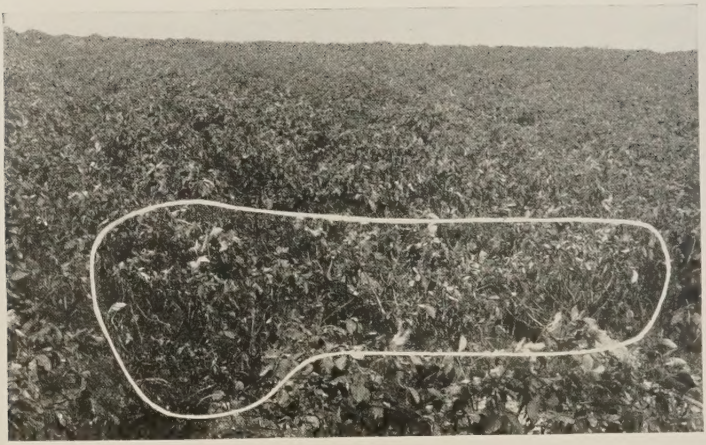

Fig. 7. Late blight beginning in the field. The spot inside the white line shows a place where late blight started in a large field of potatoes from an infected seed potato. From such centers as this the blight spreads thru the field.

the leaves. One plant infested in this manner may mean the destruction of the whole field as well as adjoining fields. Such an infection center is shown in fig. 7. The spores are blown from one place to another by the wind. It does not become destructive until late in August and early September, thus the name late blight.

Control: All of the varieties we grow in Iowa are very subject to this disease but the early varieties usually mature before late blight gets well started. This disease is efficiently controlled by four or five applications of bordeaux mixture, the same as recommended for tip burn and early blight. However no one need fear this disease unless we have a wet, cool season during July, August, and September like that of 1915.

The habits of this disease are so well understood and so dependent on the weather conditions that it can be predicted from two to three weeks in advance whether an epidemic will occur. If an outbreak of this disease seems imminent, every grower in Iowa will be advised through the Agricultural Extension service as to the time to begin fighting it.

GENERAL INFORMATION ON POTATO GROWING

WHAT VARIETIES TO GROW

For an early potato either the Early Ohio or Irish Cobbler is best suited for Iowa conditions. The former is a long potato with a reddish cast in the flesh, the latter is a round white potato with deep eyes. These should be planted just as soon as the ground is in condition in the spring. This allows the plants to make a considerable proportion of their growth before the hot weather of July and August sets in.

Among the late sorts the Rural New Yorker is best suited to Iowa conditions. It is quite resistant to black leg and curly dwarf and suffers less from tip burn than any other sort grown in Iowa. One year with another it is best to plant late varieties just as soon as the early sorts.

SEED DISINFECTION

The object of treating seed potatoes is to kill the germs of black leg and potato scab on the surface of the tubers. For this purpose a dilute solution of formalin is very effective. This can be purchased at any drug store at usually less than 25 cents per pt.

Formalin (40 per cent formaldehyde)	1 pint
Water	30 gallons

Soak tubers two hours.

The tubers should be spread out on a clean surface so as to dry quickly after treating. This solution may be used five times before it becames ineffective. It should not be kept over from one day to another because it loses strength. Potatoes should always be treated before they are cut, never afterwards, it injures the seed.

HAVE A SEED PLOT AND PRACTICE FIELD SELECTION

It is an old saying that like produces like and potatoes are no exception to the rule. Every farmer should be just as particular about selecting and caring for his seed potatoes as he is about his seed corn. No one thinks of taking ears for seed from undesirable hills. It is fully as important to exercise this principle in the case of potatoes as in the case of corn.

Set aside a sufficient number of rows as a seed plot for the next season's seed. Examine all the plants in this plot for signs of black leg, curly dwarf, weak plants, or varietal mixtures. Many of these can be rogued out when cultivating. However, it will pay to go through the seed plot several times and dig out the sick or weak plants. The remaining healthy plants may be harvested in the usual way. The potatoes from the seed plot should be kept separate from the other potatoes and held in good storage.

In the spring the potatoes set aside for seed should be sorted and all the extra large and small ones discarded for seed purposes. They may be used for table purposes. The remainder should be treated with the formalin before cutting. When the tubers are cut for seed any showing discoloration about the stem end or rotten spots should be discarded. Poor seed, such as the small ones not fit for table purposes, means a half crop.

CULTIVATION OF POTATOES

Potatoes need very good cultivation all thru the growing season and especially during the hot dry weather of July and August. All weeds should be kept down and as the crop approaches maturity, practice surface cultivation only. Do not stop at blossoming. Potatoes should be cultivated often enough to maintain a dust mulch, particularly during July and August. This keeps down the weeds, conserves the soil moisture for the plant and keeps the potato in active growing condition, thus making it less susceptible to plant diseases.

POTATO SPRAYING

The best spray mixture for tip burn, early blight, and late blight is bordeaux mixture. Unless the season is exceptionally wet as in 1915, no consideration need be given to spraying for late blight. Bordeaux mixture is made by mixing blue vitriol, commonly known as "blue stone," and freshly slaked lump lime (be sure that it is good lump lime) in the following proportion:

4 pounds	Blue vitriol
4 pounds	Burned lime
50 gallons	Water

If one has only a small patch of potatoes to spray, the blue vitriol may be dissolved in 25 gallons of water and the burned lime slaked and diluted in 25 gallons more and the two solutions poured thru a strainer simultaneously so as to afford a thoro mixing. It is now ready to apply to the potato vines by means of a good pressure sprayer, either of the knap-sack or wheel-power type. Remember that the greater the pressure maintained the finer the mist and the greater the benefit from the spraying. Fifty gallons of mixture will cover once from one-half to three-quarters of an acre. Bordeaux mixture deteriorates with standing so it should be made up as needed. The blue vitriol and slaked lime solutions will keep indefinitely without deteriorating if well covered so as to prevent excessive evaporation. Bordeaux mixture can be preserved, however, by adding one ounce of sugar to every 25 gallons of the mixture. Blue vitriol is so expensive at present that one should plan the preparation of the bordeaux so as to have none left over.

Where one has five acres or more, it is best to make up stock

solutions of blue stone and lime. Dissolve 25 pounds of blue stone in 25 gallons of water and slake 25 pounds of lump lime and dilute to 25 gallons. If one has a large acreage it is best to weigh up stock solutions of 100 or 200 pounds at one time. Take five gallons of each mixture and dilute same to 25 gallons and mix the two by pouring them simultaneously through a strainer into the spray tank. Stirring the mixture is very essential for its preparation.

It should be applied with a power pressure. There are several makes of good sprayers which cost from $80 to $100.

TIME TO SPRAY

Potato spraying should begin early in July when the hot weather sets in. Two applications should be made on early varieties and five on late sorts. The applications should be made about 10 days apart.

SPRAY FOR THE POTATO BEETLE

The potato bug is readily controlled by spraying either with paris green or lead arsenate in solution or in dust form. When used as a liquid use the following proportions:

Paris green, 1 pound to 50 gallons of water.
Powdered lead arsenate, 1 to 2 pounds to 50 gallons of water.
Paste arsenate of lead, 3 pounds to 50 gallons of water.

The powdered lead arsenate is effective and cheaper under existing conditions than the other two mixtures. If one has only a small patch to cover, one tablespoonful to one gallon of water makes an effective solution. These insecticides may be applied separately or mixed with bordeaux mixture. If a pressure sprayer is not available it may be applied with a sprinkling can.